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TECHNICAL FIELD

[Industrial Application]This invention relates to heat treatment of the disc substrate of magneto-optical discs, such as an added-a postscript type optical disc with organic dye films, such as CD-R or DVD-R, and MO, and MD.

PRIOR ART

[Description of the Prior Art]Generally, if it is in CD-R or DVD-R, a liquefied organic-coloring-matter material is uniformly applied to the disc substrate by which injection molding was carried out by methods, such as a spin coat, thin organic coloring matter is formed, and it uses as record film which can rewrite this organic dye film. The organic-coloring-matter material before spreading is liquefied with the solvent, after it usually applies organic-coloring-matter liquid to a disc substrate uniformly, removes a solvent thoroughly, and is heat-treating and drying it in many cases for improvement in the quality of an optical disc, stabilization, stabilization of a regenerative signal, etc. [0003]In the conventional case, this heat treatment supplies hot air or a gas like nitrogen to a heat treatment chamber at a wind speed smaller than 1 m/s, i.e., a very loose wind speed, and raises the temperature of the whole disc substrate surface conveyed one by one in that heat treatment chamber to about 50-150 **. Predetermined time maintenance of this temperature is carried out, and the desired end is attained by heat-treating. Thus, hot air or a gas like nitrogen is passed in a heat treatment chamber at a wind speed smaller 1 m /than s in order to make temperature in a heat treatment chamber uniform. If air with a temperature of about 50-150 ** or a gas like nitrogen is passed in a heat treatment chamber at the wind speed of 1 or more m/s, the temperature of the whole disc substrate surface will become uneven.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]Therefore, as a heat treating method of the conventional disc substrate, about 50-150 ** hot air or a gas like nitrogen is passed in the heat treatment chamber at the wind speed smaller than 1 m/s. So that it may be shown in

a long time, for example, drawing 11, by the time the whole disc substrate surface goes up to a desired temperature uniformly in this case However, since [15 part grade or since / although not illustrated, / it takes 20 to 30 minutes], While the heat treatment chamber had to be lengthened and the whole device enlarged it, there was a fault that apparatus cost became high. In order that this invention may solve such a conventional problem, a thermal treatment equipment A temperature-up part, Constitute from three, a constant temperature attaching part and a cooling unit, and the rise in heat of the disc substrate is carried out in a temperature-up part to a short time, for example, a temperature predetermined in 1 or less minute, At a constant temperature attaching part, predetermined carries out heat-treating-time maintenance of the disc substrate temperature stably, by a cooling unit, it is made to fall to the temperature below lower limit temperature less than in a short time, for example, 1 minute, this miniaturizes the whole thermal treatment equipment, and shortening of heat treating time is also aimed at.

EFFECT OF THE INVENTION

[Effect of the Invention]As stated above, according to this invention, the heat treating time of the disc substrate of an added-a postscript type optical disc with organic dye films, such as CD-R or DVD-R, can be shortened substantially, and a thermal treatment equipment can be miniaturized. In the invention of claim 10, a disc substrate can be laid in a conveyer style through the support member of a conveyer style.
Therefore, the usual transfer machine style is employable, and it can transfer to a conveyer style, without giving a shock to a disc substrate.
By the invention of claim 11, it has further again structure which can absorb the thermal expansion and contraction of a conveyer style.
Therefore, a disc substrate is not damaged by the thermal expansion and contraction of a conveyer style.

MEANS

[Means for Solving the Problem]In order to solve this technical problem, an invention of claim 1, A rapid temperature rising step which sprays a gas of temperature of a range lower than softening temperature of said disc substrate on said disc substrate at a wind speed of 1 - 10 m/s from 50 **, and raises temperature of these disc substrates quickly in a disposal method of a disc substrate, In a field of a temperature of a range lower than softening temperature of said disc substrate, from 50 **. A heat treating method of a disc substrate which consists of a temperature retaining process to which predetermined carries out time maintenance of said temperature to which said disc substrate went up, and a quenching process which spray a gas of temperature below a room temperature grade on said disc substrate at a wind speed of 1 - 10 m/s, and to which the temperature is reduced quickly is proposed. According to this invention, since a disc substrate can be raised to prescribed temperature in a short time and it can be made to fall to a room temperature for a short time, heat treating time can be shortened substantially.
[0006]In claim 1, an invention of claim 2 is crossed to a process from said rapid temperature rising step to said quenching process in order to solve an aforementioned

problem, It arranges at an interval which exists so that said disc substrate may become almost right-angled to a transporting direction of said disc substrate, and a heat treating method of a disc substrate which sprays said each gas from a direction which becomes almost right-angled to a transporting direction of said disc substrate is proposed. since a gas passes through between disc substrates at high speed according to claim 2 -- a short time -- a disc substrate -- temperature up -- or the temperature can be made to lower

[0007]In order that an invention of claim 3 may solve an aforementioned problem, they are three fields divided with a shield wall with an opening of a round form with a bigger diameter than a diameter of said disc substrate, A temperature-up part which sprays a heated gas on said disc substrate, and raises the temperature quickly, A constant temperature attaching part which carries out predetermined time maintenance of said temperature to which said disc substrate went up with a heated gas, A heat treatment chamber which consists of a cooling unit to which temperature of said disc substrate is quickly reduced by spraying a gas of temperature below a room temperature grade on said disc substrate, A thermal treatment equipment of a disc substrate provided with a conveyer style conveyed one by one where said two or more disc substrates are put in order so that it may become parallel mutually at a certain interval is proposed. Since according to claim 3 a disc substrate can be raised to prescribed temperature in a short time and it can be made to fall to a room temperature for a short time, heat treating time can be shortened substantially and a thermal treatment equipment can be miniaturized.

[0008]In [in order that an invention of claim 4 may solve an aforementioned problem] claim 3, Said temperature-up part proposes a thermal treatment equipment of a disc substrate which sprays a gas of temperature of a range lower than softening temperature of said disc substrate on said disc substrate at a wind speed of 1 - 10 m/s from 50 **, and raises temperature of these disc substrates quickly. Thus, since a disc substrate can be raised to urgency to preset temperature, a thermal treatment equipment can be miniaturized.

[0009]In an invention of claim 5, in order to solve an aforementioned problem, in claim 3 or claim 4, said constant temperature attaching part from 50 ** in atmosphere of temperature of a range lower than softening temperature of said disc substrate, A thermal treatment equipment of a disc substrate which holds almost uniformly temperature of said disc substrate by which temperature up was carried out in said temperature-up part is proposed. Since an interval between disc substrates to convey can be made smaller, a thermal treatment equipment can be miniaturized more.

[0010]In [in order to solve an aforementioned problem in an invention of claim 6] either claim 3 thru/or claim 5, Said cooling unit is sprayed on said disc substrate to which a gas of temperature below a room temperature grade is transported from said constant temperature attaching part at a 1-10 m/s wind speed, and a thermal treatment equipment of a disc substrate to which temperature of these disc substrates is reduced quickly is proposed. According to claim 6, the length of a cooling unit can be shortened and a thermal treatment equipment can be miniaturized more.

[0011]In [in order to solve an aforementioned problem in an invention of claim 7] either claim 3 thru/or claim 6, Both sides or one side of said temperature-up part and a cooling unit is shorter than length and this long to a transportation direction of said disc substrate, And it has a gas blowout hole which consists of a slit which has width smaller than a diameter of said disc substrate, This gas blowout hole is arranged at a position which

counters a portion of an overall diameter of said disc substrate in one of the four walls along a transportation direction of said disc substrate, A thermal treatment equipment of a disc substrate with which a wall in which it counters of said walls in which said gas blowout hole was formed was equipped with a gas discharge hole is proposed. Since a gas can be blown off uniformly and a gas can pass through between disc substrates at a quick speed, time of temperature up of a disc substrate and a temperature fall can be shortened more.

[0012]In [in order to solve an aforementioned problem in an invention of claim 8] either claim 3 thru/or claim 7, Said constant temperature attaching part is provided with a gas supply part which consists of a hole of a large number provided in one of the four walls along a transportation direction of said disc substrate, A thermal treatment equipment of a disc substrate which a wall in which it counters of said walls in which said gas supply part was formed was equipped with a gas discharge part, and was provided with a gas control means for adjusting a size of a hole of the large number to said gas supply part is proposed. Since quantity of supplied gas can be adjusted, a constant temperature attaching part can be more easily held to preset temperature.

[0013]In an invention of claim 9, in order to solve an aforementioned problem, in either claim 3 thru/or claim 8, said two or more disc substrates propose a thermal treatment equipment of a disc substrate put in order and conveyed so that it may become parallel mutually at the predetermined intervals.

[0014]They are three fields divided with an invention of claim 10 with a shield wall which has an opening of a round form with a bigger diameter than a diameter of said disc substrate in order to solve an aforementioned problem, A heat treatment chamber which consists of a constant temperature attaching part which carries out predetermined time maintenance of the temperature to which a temperature-up part which sprays a heated gas on said disc substrate, and raises the temperature quickly, and said disc substrate went up, and a cooling unit to which temperature of said disc substrate is reduced quickly, Where said two or more disc substrates are put in order so that it may become parallel mutually at a certain interval, have a conveyer style conveyed one by one, and said conveyer style, A shaft for a transfer with a slot spirally formed in a fixed pitch covering a certain whole length or length Three or more. It consists of a drive for rotating a shaft for these transfers, and a support member of a couple which supports both ends of a shaft for these transfers movably, respectively so that said shaft for a transfer can be rotated, This support member proposes a thermal treatment equipment of a disc substrate which is the hollow part which a part corresponding to a center hole of said disc substrate transferred to said three or more shafts for a transfer opened. According to claim 10, a disc substrate can be transferred to a shaft for a transfer calmly and easily, without giving a shock.

[0015]They are three fields divided with an invention of claim 11 with a shield wall which has an opening of a round form with a bigger diameter than a diameter of said disc substrate in order to solve an aforementioned problem, A heat treatment chamber which consists of a constant temperature attaching part which carries out predetermined time maintenance of the temperature to which a temperature-up part which sprays a heated gas on said disc substrate, and raises the temperature quickly, and said disc substrate went up, and a cooling unit to which temperature of said disc substrate is reduced quickly, Where said two or more disc substrates are put in order so that it may become parallel mutually at a certain interval, have a conveyer style conveyed one by one, and said conveyer style,

A shaft for a transfer with a slot spirally formed in a fixed pitch covering a certain whole length or length Three or more. It consists of a drive for rotating a shaft for these transfers, and a support member of a couple which supports both ends of a shaft for these transfers movably, respectively so that said shaft for a transfer can be rotated, Between said support member and a base member supporting this, it has a linear drive, and a thermal treatment equipment of a disc substrate which enabled it to move said support member according to elasticity by a temperature change of said shaft for a transfer is proposed. According to claim 11, an adverse effect to a disc substrate by thermal expansion of a shaft for a transfer can be lost.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is the figure seen from the side for describing one example of this invention.
[Drawing 2]It is the figure seen from the upper surface for describing one example of this invention.
[Drawing 3]It is a figure showing the portion which blows off the gas in one example of this invention.
[Drawing 4]It is a figure showing an example of the top plate in one example of this invention.
[Drawing 5]It is the figure seen from the side for describing another example of this invention.
[Drawing 6]It is the figure seen from the side for describing another example of this invention.
[Drawing 7]It is a figure showing a part of conveyer style for describing one example of this invention.
[Drawing 8]It is a figure showing a part of conveyer style for describing one example of this invention.
[Drawing 9]It is a figure showing an example of the temperature rise property of the disc substrate in this invention.
[Drawing 10]It is a figure showing an example of the temperature-reduction characteristic of the disc substrate in this invention.
[Drawing 11]It is a figure showing an example of the temperature rise property of the disc substrate in the former.
[Drawing 12]It is a figure showing an example of the temperature-reduction characteristic of the disc substrate in the former.
[Description of Notations]
1-heat treatment chamber 2, 3-sidewall plate
4, 5-diaphragm 6-temperature-up part
7-constant temperature attaching part 8-cooling unit
9-conveyer style 9a - 9c-carrying shaft
10-disc substrate Blow-off board of the 11a-temperature-up part 6
Discharging plate of the 11b-temperature-up part 6 Blow-off board of the 12a-constant temperature attaching part 7

Discharging plate of the 12b-constant temperature attaching part 7 Blow-off board of the 13a-cooling unit 8
Discharging plate of the 13b-cooling unit 8 S-slit
H-hole F1, F2, F3-high efficiency particulate air filter
Bearing plate of 15-conveyer style 15 16a - 16c-bearing
17-adsorption means 18-base means
19-guide rail 20-linear drive
21-attaching means 22-radial bearing
23-bolt

EXAMPLE

[An embodiment of the invention and an example] A thermal treatment equipment of a disc substrate with which an organic dye film as record film was formed A temperature-up part, Constitute from three, a constant temperature attaching part and a cooling unit, and a gas with a temperature of about 50-150 ** is sprayed on a disc substrate at a wind speed of 1 - 10 m/s in a temperature-up part, For example, as shown in drawing 9, the rise in heat of the disc substrate is carried out to a predetermined temperature (for example, 80 **) in a short time for about 60 seconds, By equalizing temperature of the whole disc substrate surface by a constant temperature attaching part, and spraying a gas with a temperature of about 20-30 ** on a disc substrate at a wind speed of 1 - 10 m/s by a cooling unit, It is made to fall to a room temperature of about 35 ** or less in a short time for 1 or less minute, this miniaturizes the whole thermal treatment equipment, and shortening of heat treating time is also aimed at.
[0017]Drawing 1 and drawing 2 explain one example of this invention. The figure which drawing 1 looked at from the side, and drawing 2 are the figures seen from the upper surface. In these figures, the heat treatment chamber 1 which becomes a drying furnace is divided into three rooms, the temperature-up part 6, the constant temperature attaching part 7, and the cooling unit 8, by the sidewall plates 2 and 3 of two sheets, and the same diaphragms 4 and 5 of two sheets as these. The disc substrate 10 will carry out ****** passage of these temperature-up part 6, the constant temperature attaching part 7, and the cooling unit 8 by the conveyer style 9. The disc substrate 10 is a thing in the middle of the manufacturing process of CD-R which is a write once optical disk, or DVD-R.
For example, the organic-coloring-matter thin film which consists of a record pigment material and an organic solvent with a spin coat method etc. is formed.
Desiccation is performed in this heat treatment chamber 1, an organic solvent is removed, and the metal thin film which turns into a reflection film or a half-reflection film at the following process is formed. The conveyer style 9 which conveys the disc substrate 10 consists of the carrying shafts 9a, 9b, and 9c with the slot spirally formed in the predetermined pitch, and many disc substrates stand 10 perpendicularly with a prescribed interval, and it sends them one by one.
[0018]A great deficit bigger [although not illustrated about the details of the sidewall plates 2 and 3 and the diaphragms 4 and 5] in order to pass the disc substrate 10 satisfactorily fundamentally than the diameter of the disc substrate 10, It has three bigger small holes than the diameter of the carrying shafts 9a, 9b, and 9c so that rotation of the carrying shafts 9a, 9b, and 9c may not be barred. The carrying shafts 9a, 9b, and 9c are

arranged at each corner of 2 equilateral triangle which makes the carrying shaft 9b a vertex, and they are sent ahead one by one, maintaining a prescribed interval by work of the slot currently formed in them when the carrying shafts 9a, 9b, and 9c rotate. It is constituted by a common motor and follower roller, the belt, etc. although it excluded illustrating about the drive of the carrying shafts 9a, 9b, and 9c. In order to simplify a drawing, the conveyer style of the same structure was completely installed in parallel with the conveyer style 9 in practice, but it omitted illustrating.

[0019]It is in such a thermal treatment equipment, as an arrow shows, a hot wind blows off from the jet hole which blew off in the temperature-up part 6 and the constant temperature attaching part 7, and was formed in the board 11a, and in the cooling unit 8, the air below a room temperature or a gas like nitrogen blows off, and it blows off from the board 13a. The hole which spouts a hot wind in the temperature-up part 6 is the slit S formed in the blow-off board 11a long and slender, as shown in drawing 3.

The slit S is located right above the crowning of the disc substrate 10 transported one by one, and it is supplied so that a hot wind may meet a transportation direction from the slit S at perpendicularity, i.e., the round form side of the disc substrate 10.

one or more slits S come out, and there are, length is almost equal to the length of the transportation direction of the temperature-up part 6, and the width is adjusted so that a suitable quantity of a hot wind may flow through both sides focusing on the line which connects the lower crowning which counters from the upper crowning of the disc substrate 10 which faces a slit. The slit width is adjusted with the temperature of the interval between the disc substrates 10 which adjoin each other by the width adjustment means 11c, a heating up time, and a hot wind, air capacity, and a wind speed. The interval between the adjacent disc substrates 10 in this temperature-up part 6 has the field of carrying out the rise in heat of the whole surface of the disc substrate 10 uniformly, and shortening that length of half-both directions, and miniaturizing a device as much as possible to the good range of 0.5 mm thru/or 2 mm.

[0020]Although the disc substrate 10 stood at such an interval passes the temperature-up part 6 in about 1 minute, The gas heated by temperature (for example, 110-130 **) lower than the softening temperature of a disc substrate from 50 ** with the heater which is not illustrated as mentioned above, The wind speed of 1 - 10 m/s, and by blowing off at a 2-5 m/s wind speed preferably, and spouting from the slit of the board 11a, When each disc substrate 10 was measured at the entrance of the following constant temperature attaching part 7, going up to prescribed temperature lower than the softening temperature temperature of a disc substrate, that is, going up to prescribed temperature in 1 or less minute was checked. Therefore, in this example, the time which takes the disc substrate 10 to go up to prescribed temperature lower than that softening temperature temperature is understood that it becomes short substantially, that is, can shorten substantially carrying distance of the disc substrate 10 in this period compared with the former. It discharges and circulates through the hot wind which blew off from the slit from many holes or slits which were provided in the discharging plate 11b of the temperature-up part 6 bottom through between the disc substrates 10.

[0021]Next, in the constant temperature attaching part 7, the temperature of each disc substrate 10 by which temperature up was carried out to prescribed temperature in the temperature-up part 6 is raised, or without making it fall, it holds to the preset temperature and an organic solvent is removed from the organic-coloring-matter thin film

of the disc substrate 10 nearly thoroughly. As shown in drawing 4, many holes H are formed in the blow-off board 12a of the constant temperature attaching part 7.
It has the baffle plate 12c which can adjust the size of those holes.
It is in the state in which drawing 4 (A) opened many holes H fully, and the state in which drawing 4 (B) closed many holes H altogether, and the size of the hole H is adjusted by moving the baffle plate 12c to an arrow direction. From these holes H, it is supplied so that a hot wind may meet a transportation direction at perpendicularity, i.e., the round form side of the disc substrate 10. The temperature of this hot wind is a little high in said preset temperature extent, and 1 or less m/s of wind speeds are 0.2 - 0.5 m/s preferably. Although the constant temperature attaching part 7 just maintains the atmosphere at said preset temperature extent, compared with the temperature-up part 6, the length of the transportation direction of a disc substrate becomes quite long by the heat treating time generally demanded. Here, also conventionally, if heat treatment with preset temperature is required also of this invention for about 10 minutes, the constant temperature attaching part 7 must have about 10 times [of the temperature-up part 6] length from the above. However, the processing number of sheets of the disc substrate 10 here is the same, then the former and this invention become equivalent. It discharges and circulates through the hot wind which blew off from many holes H of the blow-off board 12a from many holes or slits which were provided in the discharging plate 12b of the constant temperature attaching part 7 bottom through between the disc substrates 10.
[0022]Thus, it dries being conveyed one by one by the conveyer style 9 in the constant temperature attaching part 7, and the disc substrate 10 is sent to the cooling unit 8 through the diaphragm 5. It only differs in that the structure of the cooling unit 8 is the almost same structure as the temperature-up part 6, and the temperature of the gas which blows off from the slit of the blow-off board 13a is a room temperature grade and the temperature which is 20-30 **, for example. In the cooling unit 8, since the gas about a room temperature was preferably sprayed on the disc substrate 10 at the wind speed of 2 - 5 m/s one to 10 m/s, as drawing 10 showed, falling from an experiment from said preset temperature to a room temperature grade in time for 30 or less seconds was checked. By this point and the conventional method, it turns out that it takes about 6 minute from drawing 12. Therefore, in this example, the length of the cooling unit 8 was decided for the disc substrate 10 to apply for about 30 seconds to 60 seconds, and to pass the cooling unit 8 in consideration of the bearer rate of the disc substrate 10. The air used for cooling also by the cooling unit 8 is discharged from the slit of many which were provided in the discharging plate 13b which is not illustrated, or many holes.
[0023]Although it was made to flow in the 1st example described above between the disc substrates 10, without having enlarged a little disc substrate 10 interval which adjoins each other on the basis of the wind speed of the gas of the temperature-up part 6 and the cooling unit 8, and a gaseous wind speed falling not much, The wind speed of the heated gas was based on between the disc substrates 10 in the low constant temperature attaching part 7 in the 2nd example shown in drawing 3. Since what is necessary is just to hold the temperature of the disc substrate 10 in the constant temperature attaching part 7, the interval between the disc substrates 10 may be small enough, but. Since it had to be made to have to flow between the disc substrates 10, without a gaseous wind speed falling not much in the temperature-up part 6 and the cooling unit 8, the interval between the disc substrates 10 in the temperature-up part 6 and the cooling unit 8 was enlarged.

[0024]Drawing 5 in which the situation where the inside of a heat treatment chamber was seen in the side is shown shows one example which used the conveyer style 9 of the interval variable type. The conveyer style 9 of the interval variable type uses the carrying shaft (by a diagram, only 9a is shown.) of the three same structures like said example, the feed pitch covering the length in the temperature-up part 6 and the cooling unit 8 of each carrying shaft is large, and the feed pitch in the constant temperature attaching part 7 is small. Since the bearer rate of the disc substrate 10 becomes large in the temperature-up part 6 and the cooling unit 8 as a feed pitch is large, only the part must be lengthened, but since only the time of a for [about 1 minute] should be in the temperature-up part 6 and the cooling unit 8, the increment of the length of the temperature-up part 6 and the cooling unit 8 is slight. Since the heat treating time in the constant temperature attaching part 7 is long compared with it, compared with the temperature-up part 6 and the cooling unit 8, remarkable length is required for the constant temperature attaching part 7, By making small the feed pitch in the constant temperature attaching part 7, making the bearer rate of the disc substrate 10 small, and shortening the length of the constant temperature attaching part 7, the length of the heat treatment chamber 1 whole can be shortened, and the miniaturization of a device is attained further. Since it is the same as that of the 1st example about others, explanation is omitted.
[0025]Next, drawing 6 in which the situation where the inside of a heat treatment chamber was seen in the side is shown, One example which provided HEPA (HEPA) filter F1 which is a high efficiency filter, F2, and F3 (for example, class 100), respectively in the part equivalent to the blow-off board 11a of the temperature-up part 6 shown in drawing 1 and drawing 2, the blow-off board 12a of the constant temperature attaching part 7, and the blow-off board 13a of the cooling unit 8 is shown. Although the heat treatment chamber 1 was established in the clean room from the first, said heat treatment was performed in the atmosphere which is not usually so high as for an air cleanliness class. Since a gas is blown into the heat treatment chamber 1 in this example, by making the air cleanliness class of that gas high through a high efficiency particulate air filter, the air cleanliness class of the heat treatment chamber 1 will be raised more, and the characteristic of an optical disc will be raised.
[0026]the gas heated by temperature (for example, 110-130 **) lower than the softening temperature of a disc substrate from 50 ** with the heater which is not illustrated as mentioned above in the temperature-up part 6 -- the wind speed of 1 - 10 m/s -- it is blowing off through high efficiency particulate air filter F1 at the wind speed of 2 - 5 m/s preferably. It is supplied so that a hot wind may meet a transportation direction by this at perpendicularity, i.e., the round form side of the disc substrate 10. Next, in the constant temperature attaching part 7, it is higher than this hot wind a little, or 1 or less m/s of wind speeds blow off the gas of said preset temperature extent through the high efficiency particulate air filter F2 at the wind speed of 0.2 - 0.5 m/s preferably, and the atmosphere of the constant temperature attaching part 7 is held to preset temperature. next -- the cooling unit 8 -- the gas about a room temperature -- the wind speed of 1 - 10 m/s -- it is blowing off through the high efficiency particulate air filter F3 at a 2-5 m/s wind speed preferably. Although not illustrated, a high efficiency particulate air filter is provided also in the entrance side and outlet side of the heat treatment chamber 1 if needed, and the gas of a room temperature is sprayed on the disc substrate 10 on the conveyer style 9 through a high efficiency particulate air filter.

[0027]The details of the conveyer style 9 are explained using drawing 7 and drawing 8. drawing 5 -- a carrying shaft -- nine -- a -- nine -- b -- nine -- c -- and -- these -- the same -- structure -- being parallel -- having -- having had -- a carrying shaft -- nine -- a -- ' -- nine -- b -- ' -- nine -- c -- ' -- each -- an end -- pivotable -- supporting movably -- a support member -- 15 -- 15 -- ' -- being shown -- a support member -- 15 (15') -- said -- a carrying shaft -- both ends -- respectively -- having -- having . It heat-treats simultaneously in the disc substrates 10 and 10, and is made to dry in this example at two lines.It is fixed to the inner ring of the radial bearings 16a, 16b, and 16c in which the outer ring of spiral wound gasket was attached to the support member 15, and the carrying shafts 9a, 9b, and 9c are pivotable freely to the support member 15. It is the same in the carrying shafts 9a, 9b, and 9c, and is freely supported movably pivotable in the radial bearings 16a, 16b, and 16c. a carrying shaft -- nine -- a -- nine -- b -- nine -- c -- and -- a carrying shaft -- nine -- a -- ' -- nine -- b -- ' -- nine -- c -- ' -- space -- a side -- it is -- a size -- the distraction -- carrying out -- **** -- the -- a portion -- **** -- a slot -- forming -- having -- **** -- cylindrical -- a shaft -- becoming -- **** -- not illustrating -- a belt -- passing -- not illustrating -- a driving source -- joining together -- having -- **** .
[0028]The support member 15 is provided with the slots 15b and 15c which extend down from the upper surface 15a. When transferring the disc substrate 10 by which adsorption maintenance was carried out at the carrying shafts 9a, 9b, and 9c to the adsorption means 17 attached to the tip part of the transportation arm which is not illustrated after the slot 15b applies an organic dye film to the disc substrate 10, The transportation arm which is not illustrated enters, and the important role which makes it possible to lay the disc substrate 10 in the carrying shafts 9a, 9b, and 9c calmly is played, without giving a shock to the disc substrate 10. The slot 15c also makes it possible to be calmly laid in the carrying shafts 9a, 9b, and 9c, without performing the same work as the slot 15b, and shocking disc substrate 10'. The shape of these slots 15c and 15b is not restricted, but the transportation arm which is not illustrated enters the slots 15c and 15b from space front sides, a disc substrate -- ten -- ten -- ' -- a support member -- 15 -- space -- back -- a side -- setting -- each -- a carrying shaft -- nine -- a -- nine -- b -- nine -- c -- and -- a carrying shaft -- nine -- a -- ' -- nine -- b -- ' -- nine -- c -- ' -- laying -- the time -- a transportation arm -- a fang furrow -- 15 -- c -- 15 -- b -- a wall -- not contacting -- if -- it is good . It can respond also to operation of the perpendicular direction of said transportation arm, and 180 operations of a cross direction by having the slots 15c and 15b. Since said transportation arm is in the outside of the support member 15 and it can lay near the wall of the support member 15 in the disc substrates 10 and 10, the conveyer style 9 can be shortened.
[0029]it is such -- a thermal treatment equipment -- it is -- if -- temperature up -- a part -- six -- constant temperature -- an attaching part -- seven -- setting -- a carrying shaft -- nine -- a -- nine -- b -- nine -- c -- and -- a carrying shaft -- nine -- a -- ' -- nine -- b -- ' -- nine -- c -- ' -- a rise in heat -- carrying out . Those metallic materials expand thermally by carrying out a rise in heat in the carrying shafts 9a, 9b, and 9c and the carrying shafts 9a, 9b, and 9c, distortion may be given in the process conveyed in the disc substrates 10 and 10, and this distortion may have an adverse effect on the characteristic of an optical disc. Therefore, in this example, the support member 15 was made movable among the support members 15 and 15, and support member 15' was taken as immobilization. The support member 15 is combined with the guide rail 19 fixed to the base member 18 via the linear

driving means 20 and the attaching member 21. The linear driving means 20 is a thing of the usual structure which circulates many ball bearings, and can move to a space longitudinal direction freely on the guide rail 19. Support member 15' is being fixed to base member 18'. this -- structure -- it is -- if -- a carrying shaft -- nine -- a -- nine -- b -- nine -- c -- and -- a carrying shaft -- nine -- a -- ' -- nine -- b -- ' -- nine -- c -- ' -- a rise in heat -- expanding thermally -- if -- the -- a part -- only -- a linear driving means -- 20 -- a guide rail -- 19 -- a top -- a drawing -- right-hand side -- moving -- moreover -- a room temperature -- up to -- falling -- a process -- contracting -- the time -- **** -- a drawing -- left-hand side -- moving . Therefore, distortion does not arise in the carrying shafts 9a, 9b, and 9c and the carrying shafts 9a, 9b, and 9c, and power unnecessary in the disc substrates 10 and 10 is not applied by the distortion, but there is no call ****** in the characteristic about an adverse effect.

[0030]Although touched above, the both ends of each carrying shafts 9a, 9b, and 9c and the carrying shafts 9a, 9b, and 9c are attached in the support members 15 and 15 via the usual radial ball bearing 22. a radial ball bearing -- 22 -- an outer ring of spiral wound gasket -- a bolt -- 23 -- a support member -- 15 -- 15 -- ' -- respectively -- attaching -- the -- an inner ring -- each -- a carrying shaft -- nine -- a -- nine -- b -- nine -- c -- and -- a carrying shaft -- nine -- a -- ' -- nine -- b -- ' -- nine -- c -- ' -- both ends -- fixing -- having .

[0031]In the above example, although the transfer shaft was used as a conveyer style, it may consist of other members, such as a belt. It may be four or more, without restricting to three, in using a transfer shaft. Although each supplied the gas from the ceiling side and being discharged from the bottom in the above-mentioned example, reverse may be sufficient and a gas supply mouth and an outlet may be provided in a transverse direction. Although the above example described the disc substrate of the added-a postscript type optical disc with an organic dye film like CD-R or DVD-R, The disc substrate of optical disk substrates, such as MO and MD, is heat-treating in order to reduce distortion by the stress after shaping and to aim at an improvement of various characteristics, and the heat treating method and device concerning this invention are applicable also to this heat treatment.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to heat treatment of the disc substrate of magneto-optical discs, such as an added-a postscript type optical disc with organic dye films, such as CD-R or DVD-R, and MO, and MD.

[0002]

[Description of the Prior Art]Generally, if it is in CD-R or DVD-R, a liquefied organic-coloring-matter material is uniformly applied to the disc substrate by which injection molding was carried out by methods, such as a spin coat, thin organic coloring matter is formed, and it uses as record film which can rewrite this organic dye film. The organic-coloring-matter material before spreading is liquefied with the solvent, after it usually applies organic-coloring-matter liquid to a disc substrate uniformly, removes a solvent thoroughly, and is heat-treating and drying it in many cases for improvement in the quality of an optical disc, stabilization, stabilization of a regenerative signal, etc.

[0003]In the conventional case, this heat treatment supplies hot air or a gas like nitrogen to a heat treatment chamber at a wind speed smaller than 1 m/s, i.e., a very loose wind speed, and raises the temperature of the whole disc substrate surface conveyed one by one in that heat treatment chamber to about 50-150 **. Predetermined time maintenance of this temperature is carried out, and the desired end is attained by heat-treating. Thus, hot air or a gas like nitrogen is passed in a heat treatment chamber at a wind speed smaller 1 m /than s in order to make temperature in a heat treatment chamber uniform. If air with a temperature of about 50-150 ** or a gas like nitrogen is passed in a heat treatment chamber at the wind speed of 1 or more m/s, the temperature of the whole disc substrate surface will become uneven.

[0004]
[Problem(s) to be Solved by the Invention]Therefore, as a heat treating method of the conventional disc substrate, about 50-150 ** hot air or a gas like nitrogen is passed in the heat treatment chamber at the wind speed smaller than 1 m/s. So that it may be shown in a long time, for example, drawing 11, by the time the whole disc substrate surface goes up to a desired temperature uniformly in this case However, since [15 part grade or since / although not illustrated, / it takes 20 to 30 minutes], While the heat treatment chamber had to be lengthened and the whole device enlarged it, there was a fault that apparatus cost became high. In order that this invention may solve such a conventional problem, a thermal treatment equipment A temperature-up part, Constitute from three, a constant temperature attaching part and a cooling unit, and the rise in heat of the disc substrate is carried out in a temperature-up part to a short time, for example, a temperature predetermined in 1 or less minute, At a constant temperature attaching part, predetermined carries out heat-treating-time maintenance of the disc substrate temperature stably, by a cooling unit, it is made to fall to the temperature below lower limit temperature less than in a short time, for example, 1 minute, this miniaturizes the whole thermal treatment equipment, and shortening of heat treating time is also aimed at.
[0005]
[Means for Solving the Problem]In order to solve this technical problem, an invention of claim 1, A rapid temperature rising step which sprays a gas of temperature of a range lower than softening temperature of said disc substrate on said disc substrate at a wind speed of 1 - 10 m/s from 50 **, and raises temperature of these disc substrates quickly in a disposal method of a disc substrate, In a field of a temperature of a range lower than softening temperature of said disc substrate, from 50 **. A heat treating method of a disc substrate which consists of a temperature retaining process to which predetermined carries out time maintenance of said temperature to which said disc substrate went up, and a quenching process which spray a gas of temperature below a room temperature grade on said disc substrate at a wind speed of 1 - 10 m/s, and to which the temperature is reduced quickly is proposed. According to this invention, since a disc substrate can be raised to prescribed temperature in a short time and it can be made to fall to a room temperature for a short time, heat treating time can be shortened substantially.
[0006]In claim 1, an invention of claim 2 is crossed to a process from said rapid temperature rising step to said quenching process in order to solve an aforementioned problem, It arranges at an interval which exists so that said disc substrate may become almost right-angled to a transporting direction of said disc substrate, and a heat treating

method of a disc substrate which sprays said each gas from a direction which becomes almost right-angled to a transporting direction of said disc substrate is proposed. since a gas passes through between disc substrates at high speed according to claim 2 -- a short time -- a disc substrate -- temperature up -- or the temperature can be made to lower
[0007]In order that an invention of claim 3 may solve an aforementioned problem, they are three fields divided with a shield wall with an opening of a round form with a bigger diameter than a diameter of said disc substrate, A temperature-up part which sprays a heated gas on said disc substrate, and raises the temperature quickly, A constant temperature attaching part which carries out predetermined time maintenance of said temperature to which said disc substrate went up with a heated gas, A heat treatment chamber which consists of a cooling unit to which temperature of said disc substrate is quickly reduced by spraying a gas of temperature below a room temperature grade on said disc substrate, A thermal treatment equipment of a disc substrate provided with a conveyer style conveyed one by one where said two or more disc substrates are put in order so that it may become parallel mutually at a certain interval is proposed. Since according to claim 3 a disc substrate can be raised to prescribed temperature in a short time and it can be made to fall to a room temperature for a short time, heat treating time can be shortened substantially and a thermal treatment equipment can be miniaturized.
[0008]In [in order that an invention of claim 4 may solve an aforementioned problem] claim 3, Said temperature-up part proposes a thermal treatment equipment of a disc substrate which sprays a gas of temperature of a range lower than softening temperature of said disc substrate on said disc substrate at a wind speed of 1 - 10 m/s from 50 **, and raises temperature of these disc substrates quickly. Thus, since a disc substrate can be raised to urgency to preset temperature, a thermal treatment equipment can be miniaturized.
[0009]In an invention of claim 5, in order to solve an aforementioned problem, in claim 3 or claim 4, said constant temperature attaching part from 50 ** in atmosphere of temperature of a range lower than softening temperature of said disc substrate, A thermal treatment equipment of a disc substrate which holds almost uniformly temperature of said disc substrate by which temperature up was carried out in said temperature-up part is proposed. Since an interval between disc substrates to convey can be made smaller, a thermal treatment equipment can be miniaturized more.
[0010]In [in order to solve an aforementioned problem in an invention of claim 6] either claim 3 thru/or claim 5, Said cooling unit is sprayed on said disc substrate to which a gas of temperature below a room temperature grade is transported from said constant temperature attaching part at a 1-10 m/s wind speed, and a thermal treatment equipment of a disc substrate to which temperature of these disc substrates is reduced quickly is proposed. According to claim 6, the length of a cooling unit can be shortened and a thermal treatment equipment can be miniaturized more.
[0011]In [in order to solve an aforementioned problem in an invention of claim 7] either claim 3 thru/or claim 6, Both sides or one side of said temperature-up part and a cooling unit is shorter than length and this long to a transportation direction of said disc substrate, And it has a gas blowout hole which consists of a slit which has width smaller than a diameter of said disc substrate, This gas blowout hole is arranged at a position which counters a portion of an overall diameter of said disc substrate in one of the four walls along a transportation direction of said disc substrate, A thermal treatment equipment of a

disc substrate with which a wall in which it counters of said walls in which said gas blowout hole was formed was equipped with a gas discharge hole is proposed. Since a gas can be blown off uniformly and a gas can pass through between disc substrates at a quick speed, time of temperature up of a disc substrate and a temperature fall can be shortened more.

[0012]In [in order to solve an aforementioned problem in an invention of claim 8] either claim 3 thru/or claim 7, Said constant temperature attaching part is provided with a gas supply part which consists of a hole of a large number provided in one of the four walls along a transportation direction of said disc substrate, A thermal treatment equipment of a disc substrate which a wall in which it counters of said walls in which said gas supply part was formed was equipped with a gas discharge part, and was provided with a gas control means for adjusting a size of a hole of the large number to said gas supply part is proposed. Since quantity of supplied gas can be adjusted, a constant temperature attaching part can be more easily held to preset temperature.

[0013]In an invention of claim 9, in order to solve an aforementioned problem, in either claim 3 thru/or claim 8, said two or more disc substrates propose a thermal treatment equipment of a disc substrate put in order and conveyed so that it may become parallel mutually at the predetermined intervals.

[0014]They are three fields divided with an invention of claim 10 with a shield wall which has an opening of a round form with a bigger diameter than a diameter of said disc substrate in order to solve an aforementioned problem, A heat treatment chamber which consists of a constant temperature attaching part which carries out predetermined time maintenance of the temperature to which a temperature-up part which sprays a heated gas on said disc substrate, and raises the temperature quickly, and said disc substrate went up, and a cooling unit to which temperature of said disc substrate is reduced quickly, Where said two or more disc substrates are put in order so that it may become parallel mutually at a certain interval, have a conveyer style conveyed one by one, and said conveyer style, A shaft for a transfer with a slot spirally formed in a fixed pitch covering a certain whole length or length Three or more. It consists of a drive for rotating a shaft for these transfers, and a support member of a couple which supports both ends of a shaft for these transfers movably, respectively so that said shaft for a transfer can be rotated, This support member proposes a thermal treatment equipment of a disc substrate which is the hollow part which a part corresponding to a center hole of said disc substrate transferred to said three or more shafts for a transfer opened. According to claim 10, a disc substrate can be transferred to a shaft for a transfer calmly and easily, without giving a shock.

[0015]They are three fields divided with an invention of claim 11 with a shield wall which has an opening of a round form with a bigger diameter than a diameter of said disc substrate in order to solve an aforementioned problem, A heat treatment chamber which consists of a constant temperature attaching part which carries out predetermined time maintenance of the temperature to which a temperature-up part which sprays a heated gas on said disc substrate, and raises the temperature quickly, and said disc substrate went up, and a cooling unit to which temperature of said disc substrate is reduced quickly, Where said two or more disc substrates are put in order so that it may become parallel mutually at a certain interval, have a conveyer style conveyed one by one, and said conveyer style, A shaft for a transfer with a slot spirally formed in a fixed pitch covering a certain whole length or length Three or more. It consists of a drive for rotating a shaft for these transfers,

and a support member of a couple which supports both ends of a shaft for these transfers movably, respectively so that said shaft for a transfer can be rotated, Between said support member and a base member supporting this, it has a linear drive, and a thermal treatment equipment of a disc substrate which enabled it to move said support member according to elasticity by a temperature change of said shaft for a transfer is proposed. According to claim 11, an adverse effect to a disc substrate by thermal expansion of a shaft for a transfer can be lost.

[0016]

[An embodiment of the invention and an example] A thermal treatment equipment of a disc substrate with which an organic dye film as record film was formed A temperature-up part, Constitute from three, a constant temperature attaching part and a cooling unit, and a gas with a temperature of about 50-150 ** is sprayed on a disc substrate at a wind speed of 1 - 10 m/s in a temperature-up part, For example, as shown in drawing 9, the rise in heat of the disc substrate is carried out to a predetermined temperature (for example, 80 **) in a short time for about 60 seconds, By equalizing temperature of the whole disc substrate surface by a constant temperature attaching part, and spraying a gas with a temperature of about 20-30 ** on a disc substrate at a wind speed of 1 - 10 m/s by a cooling unit, It is made to fall to a room temperature of about 35 ** or less in a short time for 1 or less minute, this miniaturizes the whole thermal treatment equipment, and shortening of heat treating time is also aimed at.

[0017]Drawing 1 and drawing 2 explain one example of this invention. A figure which drawing 1 looked at from the side, and drawing 2 are the figures seen from the upper surface. In these figures, the heat treatment chamber 1 which becomes a drying furnace is divided into three rooms, the temperature-up part 6, the constant temperature attaching part 7, and the cooling unit 8, by the sidewall plates 2 and 3 of two sheets, and the same diaphragms 4 and 5 of two sheets as these. The disc substrate 10 will carry out ****** passage of these temperature-up part 6, the constant temperature attaching part 7, and the cooling unit 8 by the conveyer style 9. An organic-coloring-matter thin film which the disc substrate 10 is a thing in the middle of a manufacturing process of CD-R which is a write once optical disk, or DVD-R, for example, consists of a record pigment material and an organic solvent with a spin coat method etc. is formed. Desiccation is performed in this heat treatment chamber 1, an organic solvent is removed, and a metal thin film which turns into a reflection film or a half-reflection film at the following process is formed. The conveyer style 9 which conveys the disc substrate 10 consists of the carrying shafts 9a, 9b, and 9c with a slot spirally formed in a predetermined pitch, and many disc substrates stand 10 perpendicularly with a prescribed interval, and it sends them one by one.

[0018]A great deficit bigger [although not illustrated about the details of the sidewall plates 2 and 3 and the diaphragms 4 and 5] in order to pass the disc substrate 10 satisfactorily fundamentally than the diameter of the disc substrate 10, It has three bigger small holes than the diameter of the carrying shafts 9a, 9b, and 9c so that rotation of the carrying shafts 9a, 9b, and 9c may not be barred. The carrying shafts 9a, 9b, and 9c are arranged at each corner of 2 equilateral triangle which makes the carrying shaft 9b a vertex, and they are sent ahead one by one, maintaining a prescribed interval by work of the slot currently formed in them when the carrying shafts 9a, 9b, and 9c rotate. It is constituted by a common motor and follower roller, the belt, etc. although it excluded

illustrating about the drive of the carrying shafts 9a, 9b, and 9c. In order to simplify a drawing, the conveyer style of the same structure was completely installed in parallel with the conveyer style 9 in practice, but it omitted illustrating.

[0019]It is in such a thermal treatment equipment, as an arrow shows, a hot wind blows off from the jet hole which blew off in the temperature-up part 6 and the constant temperature attaching part 7, and was formed in the board 11a, and in the cooling unit 8, the air below a room temperature or a gas like nitrogen blows off, and it blows off from the board 13a. The hole which spouts a hot wind in the temperature-up part 6 is the slit S formed in the blow-off board 11a long and slender, as shown in drawing 3. The slit S is located right above the crowning of the disc substrate 10 transported one by one, and it is supplied so that a hot wind may meet a transportation direction from the slit S at perpendicularity, i.e., the round form side of the disc substrate 10. one or more slits S come out, and there are, length is almost equal to the length of the transportation direction of the temperature-up part 6, and the width is adjusted so that a suitable quantity of a hot wind may flow through both sides focusing on the line which connects the lower crowning which counters from the upper crowning of the disc substrate 10 which faces a slit. The slit width is adjusted with the temperature of the interval between the disc substrates 10 which adjoin each other by the width adjustment means 11c, a heating up time, and a hot wind, air capacity, and a wind speed. The interval between the adjacent disc substrates 10 in this temperature-up part 6 has the field of carrying out the rise in heat of the whole surface of the disc substrate 10 uniformly, and shortening that length of half-both directions, and miniaturizing a device as much as possible to the good range of 0.5 mm thru/or 2 mm.

[0020]Although the disc substrate 10 stood at such an interval passes the temperature-up part 6 in about 1 minute, The gas heated by temperature (for example, 110-130 **) lower than the softening temperature of a disc substrate from 50 ** with the heater which is not illustrated as mentioned above, The wind speed of 1 - 10 m/s, and by blowing off at a 2-5 m/s wind speed preferably, and spouting from the slit of the board 11a, When each disc substrate 10 was measured at the entrance of the following constant temperature attaching part 7, going up to prescribed temperature lower than the softening temperature temperature of a disc substrate, that is, going up to prescribed temperature in 1 or less minute was checked. Therefore, in this example, the time which takes the disc substrate 10 to go up to prescribed temperature lower than that softening temperature temperature is understood that it becomes short substantially, that is, can shorten substantially carrying distance of the disc substrate 10 in this period compared with the former. It discharges and circulates through the hot wind which blew off from the slit from many holes or slits which were provided in the discharging plate 11b of the temperature-up part 6 bottom through between the disc substrates 10.

[0021]Next, in the constant temperature attaching part 7, the temperature of each disc substrate 10 by which temperature up was carried out to prescribed temperature in the temperature-up part 6 is raised, or without making it fall, it holds to the preset temperature and an organic solvent is removed from the organic-coloring-matter thin film of the disc substrate 10 nearly thoroughly. The blow-off board 12a of the constant temperature attaching part 7 is equipped with the baffle plate 12c which many holes H are formed as shown in drawing 4, and can adjust the size of those holes. It is in the state in which drawing 4 (A) opened many holes H fully, and the state in which drawing 4 (B)

closed many holes H altogether, and the size of the hole H is adjusted by moving the baffle plate 12c to an arrow direction. From these holes H, it is supplied so that a hot wind may meet a transportation direction at perpendicularity, i.e., the round form side of the disc substrate 10. The temperature of this hot wind is a little high in said preset temperature extent, and 1 or less m/s of wind speeds are 0.2 - 0.5 m/s preferably. Although the constant temperature attaching part 7 just maintains the atmosphere at said preset temperature extent, compared with the temperature-up part 6, the length of the transportation direction of a disc substrate becomes quite long by the heat treating time generally demanded. Here, also conventionally, if heat treatment with preset temperature is required also of this invention for about 10 minutes, the constant temperature attaching part 7 must have about 10 times [of the temperature-up part 6] length from the above. However, the processing number of sheets of the disc substrate 10 here is the same, then the former and this invention become equivalent. It discharges and circulates through the hot wind which blew off from many holes H of the blow-off board 12a from many holes or slits which were provided in the discharging plate 12b of the constant temperature attaching part 7 bottom through between the disc substrates 10.

[0022]Thus, it dries being conveyed one by one by the conveyer style 9 in the constant temperature attaching part 7, and the disc substrate 10 is sent to the cooling unit 8 through the diaphragm 5. It only differs in that the structure of the cooling unit 8 is the almost same structure as the temperature-up part 6, and the temperature of the gas which blows off from the slit of the blow-off board 13a is a room temperature grade and the temperature which is 20-30 **, for example. In the cooling unit 8, since the gas about a room temperature was preferably sprayed on the disc substrate 10 at the wind speed of 2 - 5 m/s one to 10 m/s, as drawing 10 showed, falling from an experiment from said preset temperature to a room temperature grade in time for 30 or less seconds was checked. By this point and the conventional method, it turns out that it takes about 6 minute from drawing 12. Therefore, in this example, the length of the cooling unit 8 was decided for the disc substrate 10 to apply for about 30 seconds to 60 seconds, and to pass the cooling unit 8 in consideration of the bearer rate of the disc substrate 10. The air used for cooling also by the cooling unit 8 is discharged from the slit of many which were provided in the discharging plate 13b which is not illustrated, or many holes.

[0023]Although it was made to flow in the 1st example described above between the disc substrates 10, without having enlarged a little disc substrate 10 interval which adjoins each other on the basis of the wind speed of the gas of the temperature-up part 6 and the cooling unit 8, and a gaseous wind speed falling not much, The wind speed of the heated gas was based on between the disc substrates 10 in the low constant temperature attaching part 7 in the 2nd example shown in drawing 3. Since what is necessary is just to hold the temperature of the disc substrate 10 in the constant temperature attaching part 7, the interval between the disc substrates 10 may be small enough, but. Since it had to be made to have to flow between the disc substrates 10, without a gaseous wind speed falling not much in the temperature-up part 6 and the cooling unit 8, the interval between the disc substrates 10 in the temperature-up part 6 and the cooling unit 8 was enlarged.

[0024]Drawing 5 in which the situation where the inside of a heat treatment chamber was seen in the side is shown shows one example which used the conveyer style 9 of the interval variable type. The conveyer style 9 of the interval variable type uses the carrying shaft (by a diagram, only 9a is shown.) of the three same structures like said example, the

feed pitch covering the length in the temperature-up part 6 and the cooling unit 8 of each carrying shaft is large, and the feed pitch in the constant temperature attaching part 7 is small. Since the bearer rate of the disc substrate 10 becomes large in the temperature-up part 6 and the cooling unit 8 as a feed pitch is large, only the part must be lengthened, but since only the time of a for [about 1 minute] should be in the temperature-up part 6 and the cooling unit 8, the increment of the length of the temperature-up part 6 and the cooling unit 8 is slight. Since the heat treating time in the constant temperature attaching part 7 is long compared with it, compared with the temperature-up part 6 and the cooling unit 8, remarkable length is required for the constant temperature attaching part 7, By making small the feed pitch in the constant temperature attaching part 7, making the bearer rate of the disc substrate 10 small, and shortening the length of the constant temperature attaching part 7, the length of the heat treatment chamber 1 whole can be shortened, and the miniaturization of a device is attained further. Since it is the same as that of the 1st example about others, explanation is omitted.

[0025]Next, drawing 6 in which the situation where the inside of a heat treatment chamber was seen in the side is shown, One example which provided HEPA (HEPA) filter F1 which is a high efficiency filter, F2, and F3 (for example, class 100), respectively in the part equivalent to the blow-off board 11a of the temperature-up part 6 shown in drawing 1 and drawing 2, the blow-off board 12a of the constant temperature attaching part 7, and the blow-off board 13a of the cooling unit 8 is shown. Although the heat treatment chamber 1 was established in the clean room from the first, said heat treatment was performed in the atmosphere which is not usually so high as for an air cleanliness class. Since a gas is blown into the heat treatment chamber 1 in this example, by making the air cleanliness class of that gas high through a high efficiency particulate air filter, the air cleanliness class of the heat treatment chamber 1 will be raised more, and the characteristic of an optical disc will be raised.

[0026]the gas heated by temperature (for example, 110-130 **) lower than the softening temperature of a disc substrate from 50 ** with the heater which is not illustrated as mentioned above in the temperature-up part 6 -- a 1-10 m/s wind speed -- it is blowing off through high efficiency particulate air filter F1 at the wind speed of 2 - 5 m/s preferably. It is supplied so that a hot wind may meet a transportation direction by this at perpendicularity, i.e., the round form side of the disc substrate 10. Next, in the constant temperature attaching part 7, it is higher than this hot wind a little, or 1 or less m/s of wind speeds blow off the gas of said preset temperature extent through the high efficiency particulate air filter F2 at the wind speed of 0.2 - 0.5 m/s preferably, and the atmosphere of the constant temperature attaching part 7 is held to preset temperature. next -- the cooling unit 8 -- the gas about a room temperature -- the wind speed of 1 - 10 m/s -- it is blowing off through the high efficiency particulate air filter F3 at a 2-5 m/s wind speed preferably. Although not illustrated, a high efficiency particulate air filter is provided also in the entrance side and outlet side of the heat treatment chamber 1 if needed, and the gas of a room temperature is sprayed on the disc substrate 10 on the conveyer style 9 through a high efficiency particulate air filter.

[0027]The details of the conveyer style 9 are explained using drawing 7 and drawing 8. drawing 5 -- a carrying shaft -- nine -- a -- nine -- b -- nine -- c -- and -- these -- the same -- structure -- being parallel -- having -- having had -- a carrying shaft -- nine -- a -- ' -- nine -- b -- ' -- nine -- c -- ' -- each -- an end -- pivotable -- supporting movably -- a

support member -- 15 -- 15 -- ' -- being shown -- a support member -- 15 (15') -- said -- a carrying shaft -- both ends -- respectively -- having -- having . It heat-treats simultaneously in the disc substrates 10 and 10, and is made to dry in this example at two lines.It is fixed to the inner ring of the radial bearings 16a, 16b, and 16c in which the outer ring of spiral wound gasket was attached to the support member 15, and the carrying shafts 9a, 9b, and 9c are pivotable freely to the support member 15. It is the same in the carrying shafts 9a, 9b, and 9c, and is freely supported movably pivotable in the radial bearings 16a, 16b, and 16c. a carrying shaft -- nine -- a -- nine -- b -- nine -- c -- and -- a carrying shaft -- nine -- a -- ' -- nine -- b -- ' -- nine -- c -- ' -- space -- a side -- it is -- a size -- the distraction -- carrying out -- **** -- the -- a portion -- **** -- a slot -- forming -- having -- **** -- cylindrical -- a shaft -- becoming -- **** -- not illustrating -- a belt -- passing -- not illustrating -- a driving source -- joining together -- having -- **** .

[0028]The support member 15 is provided with the slots 15b and 15c which extend down from the upper surface 15a. When transferring the disc substrate 10 by which adsorption maintenance was carried out at the carrying shafts 9a, 9b, and 9c to the adsorption means 17 attached to the tip part of the transportation arm which is not illustrated after the slot 15b applies an organic dye film to the disc substrate 10, The transportation arm which is not illustrated enters, and the important role which makes it possible to lay the disc substrate 10 in the carrying shafts 9a, 9b, and 9c calmly is played, without giving a shock to the disc substrate 10. The slot 15c also makes it possible to be calmly laid in the carrying shafts 9a, 9b, and 9c, without performing the same work as the slot 15b, and shocking disc substrate 10'. The shape of these slots 15c and 15b is not restricted, but the transportation arm which is not illustrated enters the slots 15c and 15b from space front sides, a disc substrate -- ten -- ten -- ' -- a support member -- 15 -- space -- back -- a side -- setting -- each -- a carrying shaft -- nine -- a -- nine -- b -- nine -- c -- and -- a carrying shaft -- nine -- a -- ' -- nine -- b -- ' -- nine -- c -- ' -- laying -- the time -- a transportation arm -- a fang furrow -- 15 -- c -- 15 -- b -- a wall -- not contacting -- if -- it is good . It can respond also to operation of the perpendicular direction of said transportation arm, and 180 operations of a cross direction by having the slots 15c and 15b. Since said transportation arm is in the outside of the support member 15 and it can lay near the wall of the support member 15 in the disc substrates 10 and 10, the conveyer style 9 can be shortened.

[0029]it is such -- a thermal treatment equipment -- it is -- if -- temperature up -- a part -- six -- constant temperature -- an attaching part -- seven -- setting -- a carrying shaft -- nine -- a -- nine -- b -- nine -- c -- and -- a carrying shaft -- nine -- a -- ' -- nine -- b -- ' -- nine -- c -- ' -- a rise in heat -- carrying out . Those metallic materials expand thermally by carrying out a rise in heat in the carrying shafts 9a, 9b, and 9c and the carrying shafts 9a, 9b, and 9c, distortion may be given in the process conveyed in the disc substrates 10 and 10, and this distortion may have an adverse effect on the characteristic of an optical disc. Therefore, in this example, the support member 15 was made movable among the support members 15 and 15, and support member 15' was taken as immobilization. The support member 15 is combined with the guide rail 19 fixed to the base member 18 via the linear driving means 20 and the attaching member 21. The linear driving means 20 is a thing of the usual structure which circulates many ball bearings, and can move to a space longitudinal direction freely on the guide rail 19. Support member 15' is being fixed to base member 18'. this -- structure -- it is -- if -- a carrying shaft -- nine -- a -- nine -- b --

nine -- c -- and -- a carrying shaft -- nine -- a -- ' -- nine -- b -- ' -- nine -- c -- ' -- a rise in heat -- expanding thermally -- if -- the -- a part -- only -- a linear driving means -- 20 -- a guide rail -- 19 -- a top -- a drawing -- right-hand side -- moving -- moreover -- a room temperature -- up to -- falling -- a process -- contracting -- the time -- **** -- a drawing -- left-hand side -- moving . Therefore, distortion does not arise in the carrying shafts 9a, 9b, and 9c and the carrying shafts 9a, 9b, and 9c, and power unnecessary in the disc substrates 10 and 10 is not applied by the distortion, but there is no call ****** in the characteristic about an adverse effect.

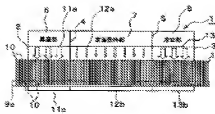
[0030]Although touched above, the both ends of each carrying shafts 9a, 9b, and 9c and the carrying shafts 9a, 9b, and 9c are attached in the support members 15 and 15 via the usual radial ball bearing 22. a radial ball bearing -- 22 -- an outer ring of spiral wound gasket -- a bolt -- 23 -- a support member -- 15 -- 15 -- ' -- respectively -- attaching -- the -- an inner ring -- each -- a carrying shaft -- nine -- a -- nine -- b -- nine -- c -- and -- a carrying shaft -- nine -- a -- ' -- nine -- b -- ' -- nine -- c -- ' -- both ends -- fixing -- having .

[0031]In the above example, although the transfer shaft was used as a conveyer style, it may consist of other members, such as a belt. It may be four or more, without restricting to three, in using a transfer shaft. Although each supplied the gas from the ceiling side and being discharged from the bottom in the above-mentioned example, reverse may be sufficient and a gas supply mouth and an outlet may be provided in a transverse direction. Although the above example described the disc substrate of the added-a postscript type optical disc with an organic dye film like CD-R or DVD-R, The disc substrate of optical disk substrates, such as MO and MD, is heat-treating in order to reduce distortion by the stress after shaping and to aim at an improvement of various characteristics, and the heat treating method and device concerning this invention are applicable also to this heat treatment.

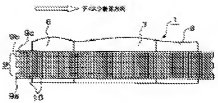
[0032]

[Effect of the Invention]As stated above, according to this invention, the heat treating time of the disc substrate of an added-a postscript type optical disc with organic dye films, such as CD-R or DVD-R, can be shortened substantially, and a thermal treatment equipment can be miniaturized. Since a disc substrate can be laid in a conveyer style through the support member of a conveyer style according to the invention of claim 10, the usual transfer machine style is employable, and it can transfer to a conveyer style, without giving a shock to a disc substrate. According to the invention of claim 11, since it has structure which can absorb the thermal expansion and contraction of a conveyer style, a disc substrate is not damaged by the thermal expansion and contraction of a conveyer style further again.

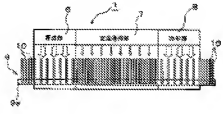
【図１】



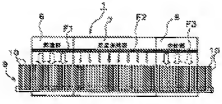
【図２】



【図５】



【図６】



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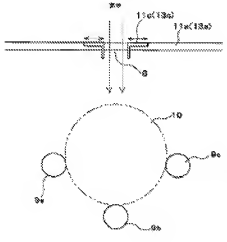

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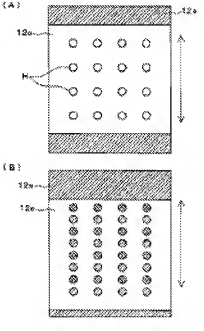

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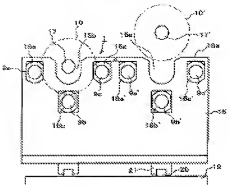

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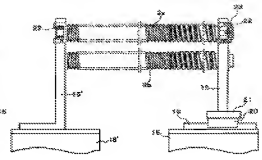

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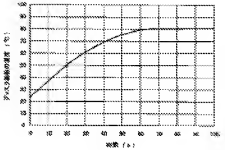
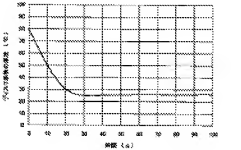
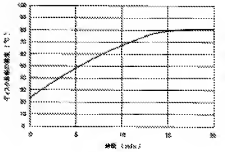


【図１０】



【図１１】



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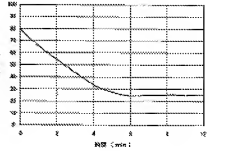

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